Guest Article

Design and Technology in the United Kingdom

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Historical Perspective

"Handicraft" was a recognized subject in the national education system of the United Kingdom (UK) almost a century ago. But it is only in the past sixty years that the curriculum area we in the UK now call "Design and Technology" has progressed from single material, craft-skill based courses for the less able to a thinking, feeling, doing activity drawing on and linking with a wide range of subject bases for all pupils of compulsory school age. In comparison to many subjects in the current school curriculum, Design and Technology is still in its infancy.

Unfortunately the English language has no single word like "literacy" or "numeracy" which might denote the activities which go on in Design and Technology. Over the years, this has had unfortunate consequences for those trying to establish and build up this important subject.

The subject which started out as Handicraft has over the years developed and evolved to encompass a growing range of activities. Early Handicraft teachers were usually classroom teachers who became craftsmen, or practicing craftsmen who, by taking a short course, obtained a qualification to teach only that subject. Its very name has altered from "Handicraft," to "Woodwork," "Metalwork," "Manual Training," "Craft," "Technical Subjects," "Design," "Craft, Design and Technology" (CDT), and now "Design and Technology." Its status and its place in the overall school curriculum has also changed as a result of these developments.

To many, the pace of development has appeared to be slow. For the first fifty years, courses in manual training were provided in certain schools for less academically able boys, while girls were allowed to study Domestic Science and Sewing, with little or no alteration as to how or what was delivered.

The changes that took place in the UK economy after World War II required a substantial increase in the skilled labor force. This, in turn, led to an

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increase in the craft and technical training that was provided for the less academic in secondary schools, albeit essentially for male pupils.

The lack of curriculum development in school based Craft Education was recognized in 1959 by C.P. Snow, who argued that the traditional values of literary culture were dominating education at the expense of science and technology. He argued that the UK would decline as a world power if the balance was not redressed (Snow, 1964; Weiner, 1986; McCulloch, Jenkins, & Layton, 1986).

It was not until the 1970s that changes in society became so marked that they brought inescapable pressure upon those responsible for the pattern of education in the UK to develop a new philosophy with regard to the education of future generations. One of the main thrusts of those taking an interest in education at this time was towards the need for pupils to possess a greater understanding and awareness of technology, its future implications, its potential, and its exploitation. Therefore, it is not surprising that the technical subjects were among the curriculum areas to be scrutinized nationally by government.

It became increasingly understood by Her Majesty's Inspectorate (HMI), industrialists, the Design Council, educationists and forward thinking teachers that a change in what was provided in technical subjects was essential (Aylward, 1973; Design Council, 1980; Arnold, 1975). There was also considerable agreement among them that this aspect of education should be accessible for all pupils.

It was at this time that changes to this area of the curriculum at last became apparent (Hargreaves, 1984). The name of the subject changed. Instead of being called Woodwork, Metalwork, Engineering Practice, etc., there was a merger of the more resistant materials (wood, metal and plastics) into Craft, Design and Technology (Breckon & Prest, 1983). The content of courses changed too (Kimbell, 1986; Department of Education & Science, 1980; Inspectorate of Schools, Craft, Design & Technology, 1983). No longer were pupils taught only craft skills; they were also encouraged to design whatever they made (Harahan, 1978). At the same time, access to the subject in lower secondary schools (ages11-14) was improved. Pupils of all ability were scheduled to participate in the new courses (Kimbell, 1982; Royal College of Art, Department of Design Research, 1976). In many instances these courses were organized into modules which pupils took on a rotational basis. These courses were nicknamed “roundabouts” or “circuses.” As well as allowing each pupil to experience as wide a variety of materials and skills as the school could provide, these courses forced girls to have access to ‘boys’ subjects and boys to have access to ‘girls’ subjects. It was hoped that this would have the effect of encouraging more girls to study technological subjects at the option stage when pupils were allowed to choose between subjects.

The pity was that two different “camps” formed among educationists (Baynes, 1976; Cross, Naughton, & Walker, 1986; Cross, 1986). Those who saw creative designing as the necessary route forward, and those who believed in a need for hard technology and a sound knowledge base. The two polarized

factions were not ready to cope with the concept of these two important facets of the curriculum being amalgamated into one. Nor could they easily accept that what went on in the Home Economics and Dressmaking areas of the curriculum might also have a part to play in Design and Technology education. As CDT was not representing "the whole" of design in this sense, it failed to present the united front necessary to persuade academics, educationists, or industrialists that it was essential to have this area of the curriculum as a core subject for all pupils.

During the 1970s and early part of the 1980s, this lack of clarity of message by HMI and prominent educationists continued to prevent CDT from securing a major role in the academic core of the school curriculum. This was further accentuated at a grass roots level by the teaching staff of CDT, Technology, Art, and Design attempting to protect what they perceived to be their individual subject boundaries. Conflicting pictures of the rank importance of CDT, hard technology, craft skills, design skills, the place of scientific knowledge, etc., prevented development of the subject (Cross & McCormick, 1986).

There continued to be educational opposition from senior members of staff in schools towards CDT, as it was still equated with vocational training for the academically less able. The Senior Management Teams within the schools, who were mainly made up of academics, with beliefs based on their own school experience, still saw intellectual work as of high status and manual work as of low status. Science Departments were also concerned with CDT's expectation of equal status. At this time, activities in many CDT departments were rightfully seen as secondary to, and dependant upon, basic science (Woolnough, 1986).

Other factors which affected this area of the curriculum were costs for necessary hardware, materials, and the staff and pupil related scheduling costs. These continue to be significant issues today as Local Financial Management of schools comes into effect.[1] Difficulties with assessment, low accreditation value, shortage of well trained teachers, and the fact that this area of the curriculum was offered under more labels at examination level than any other subject in the curriculum were additional aspects that caused concern. And yet it was against this backcloth that a positive change in attitude towards Design and Technology education started to emerge (Assessment of Performance Unit, 1981).

A debate regarding education in general was beginning to come to the front; up to this moment in time, education within schools had not been related to the outside world (Department of Education and Science, 1980; TRIST, 1987a; TRIST, 1987b). In fact, despite attempts, it appeared that there had been

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[1] Local Financial Management is part of Local Management Structure (LMS). It is being implemented in all state schools in the UK. At school level, it marks a change from local administration management to local management delegation by Local Education Authorities.

a failure to recognize the necessity to do so. Many believe that the UK lives by trade therefore they must succeed by trade. The continuing economic decline of the UK added strength to the educational movement, which supported curriculum development. Additional impetus came from industrialists with influence and/or the ability to inject money into the system. The Technical and Vocational Educational Initiative (TVEI), new examination systems, the National Curriculum, Local Financial Management (Department of Education and Science, 1988) and Equal Opportunities are just a few of the recent initiatives that have proved that, although *ad hoc* subject-based curriculum models developed by grass root teachers are an important process, large scale national intervention can cause mountains to be moved quickly. Almost too quickly for some!

National Interventions

Technical and Vocational Educational Initiative (TVEI)

TVEI influenced the whole curriculum of many secondary schools. It was set up as a pilot scheme in 1983 with 14 Local Education Authorities (LEA's) taking part. Its purpose was to help prepare pupils aged 14-18 for the demands of working life. In 1986, the government, supported by industry, announced its intention to offer funds to all LEA's to take part in the Initiative. The exact nature and content of plans were determined by LEA's and took into account their own needs and circumstances. The National Aims of TVEI sought to encourage close collaboration between LEA's and industry/commerce/public services etc., so that the school curriculum gained the confidence of industrialists (TVEI, 1987; Leicestershire County Council, 1987).

TVEI still in effect supports the aim that pupils in school need to:

- gain the qualifications which will be of direct value to them at work;
- become better equipped to enter the world of employment;
- acquire an appreciation of the practical application of the qualifications for which they are working;
- become accustomed to using their skills and knowledge to solve real-world problems; and
- develop initiative, motivation and enterprise.

The Effect of TVEI upon Design and Technology. One effect of TVEI upon Design and Technology education has been the injection of money from industry enabling change to take place. This has provided much needed hardware, often in the form of computers, at limited cost to schools. TVEI has also promoted a holistic approach to the design process carried out by pupils, encouraging business awareness and industrial links. This, in turn, has brought its rewards to the schools concerned, often in the form of expertise and equipment.

The New Examinations at the end of Compulsory Education

General Certificate of Secondary Education (GCSE). Until 1987, pupils in the UK were examined in two separate systems at the age of sixteen: the General Certificate of Education (GCE) and the Certificate of Secondary Education (CSE) examinations. GCE was for the top 20% of pupils while CSE was designed to cater to the next 60% of pupils. In fact CSE was usually attempted by the majority of the pupils who did not take examinations at GCE level. (SCUE, SCDC, SEC & CNA, 1987; Department of Education and Science, 1985)

After 1987, these two examination systems were replaced by GCSE, operated as a single system and open to all. It was introduced after many trials of new approaches to tackle weaknesses in the GCE/CSE two-tiered system.

In addition to this form of academic discrimination, there had been many inadequacies in the old two-tier examination system, other than this including:

- the difficulty in changing from one system to another
- the fact that two years work was assessed in one or two examination papers which gave a bias towards teaching that could be examined in timed written papers; and
- syllabi called for learning facts at the expense of understanding or using information.

These latter two points were felt to be particularly important by teachers who wrote examinations for Design and Technology because of the very nature of the activities involved. In addition, employers of those leaving school and those pupils who changed schools during courses found that examinations with the same title did not necessarily include the same content, levels of achievement, or expectations of the pupils.

There was also a serious mismatch between employers and teachers in terms of acceptability. Employers, the majority of whom had left school long before CSE examinations had been established, never accepted top CSE qualifications as equal to GCE. However, many teachers preferred CSE as they were professionally involved in the development of these examinations, and consequently were able to tailor them to their requirements.

The introduction of the new single examination system, however, caused many problems. The new system had to be ‘marketed’ to staff, pupils, parents and future employers who all remembered the difficulties with the acceptance of CSE. The new philosophy of GCSE and the new approaches to assessment required a great deal of in-service training for teachers in order to manage a curriculum to support a single subject examination system.

In preparation for GCSE, National Criteria were established for all subjects to give a uniform framework for examinations and syllabi. This was a major step forward in the UK examination system. The published list of National Criteria aims and objectives explained what students studying courses in all curriculum areas should seek to achieve.

One important and very positive aspect of GCSE was to establish the philosophy that all syllabi must help pupils in schools to understand a subject's

relationship to other areas of the curriculum and its relevance to their own lives and responsibilities. Also, in GCSE, assessment was no longer to be by examination alone. At least 20% of candidates' marks were to come from coursework, either in the form of project work or by continuous assessment of pupils' regular classroom activities. In the past, examinations had tended to record what candidates could not do rather than what they could do. GCSE aimed to assess positive achievement.

The Effect of GCSE on Design and Technology. GCSE allowed the development of examination courses that were far more suitable for assessing Design and Technology capability than the traditional mode of examination could ever hope to achieve. Some examinations [eg. Midlands Examining Group (MEG) Design][2] were purely an assessment of coursework. Others had a balance between coursework and written examinations. GCSE allowed schools to continue, during the examination years, with the type of work done in the lower secondary (age 11-14) Design and Technology curriculum. This is also similar to the philosophy advocated in the new National Curriculum.

The National Curriculum (NC)

One of the most important changes in education brought about by the Government's Education Reform Act of1988 was the introduction of a National Curriculum for children aged 5-16 in all state schools in England and Wales (National Curriculum Council, 1989; Department of Education and Science, 1985, 1987a, 1987b). The purpose of the National Curriculum is to ensure that all children study essential subjects, thus providing a better all around education. It is designed to ensure that children cannot opt out of subjects too early, and thereby close doors to future job opportunities and personal development. Progression from the Primary phase to Secondary should offer much more continuity for pupils in terms of style, structure and content of education. It should also make it easier for children to move from one school to another.

The National Curriculum consists of 10 subjects which all children must study at school: English, Mathematics, Science, Technology,[3] History, Geography, Music, Art, Physical Education, and a modern language from ages 11-16. For each subject there are objectives or goals outlining what children should know and be able to do at each stage of their schooling. These objectives are called “attainment targets.” For each subject there are also descriptors and programs of study detailing what children should be taught in order to help

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[2] England, Wales, and Northern Ireland are divided into 6 regional examination groups. These groups are responsible to the Secondary Examination Advisory Council (SEAC) for the organization and assessment of GCSE Examinations (Scotland has its own educational and examination system).

[3] Technology in the National Curriculum is composed of two areas of study, Design and Technology and Information Technology.

them achieve the attainment targets set. At ages 7, 11, 14, and 16 students are assessed with regard to the attainment targets. Their performance is measured on a ten point scale.

There are 4 stages for different educational age groups, known as "key stages." These should help pupils, parents, and staff to know what each child should learn at various ages. The key stages are:

- Key Stage 1 - from age 5 to 7
- Key Stage 2 - from age 7 to 11
- Key Stage 3 - from age 11 to 14
- Key Stage 4 - from age 14 to 16

The National curriculum is not the total curriculum for the child, but rather a fundamental framework. It is for each school to decide mechanisms for delivery and additional subjects they wish to provide. By law each school in the public sector must provide the National Curriculum.

The Effect of the National Curriculum on Design and Technology. The government's Statutory Orders concerning Design and Technology, were published in April 1990. They must by law be taught from September 1990 starting with Key Stage 1.

Design and Technology has been made one of the two "profile components" of the foundation subject area Technology. The other profile component is Information Technology (IT).[4] It is intended that these components are not seen as discrete subjects, but more a set of attainment targets that will need to be serviced by a wide variety of curriculum areas.

One of the most far reaching effects of the NC is the fact that all pupils from 5-16 will have to be taught the necessary information and skills, with the emphasis on process rather than content, to be able to achieve the appropriate attainment targets. In the case of Design and Technology, schools will not be able to decide that they do not wish to provide this area of the curriculum. Design and Technology, is required by law for all pupils of all abilities, ages and interests. No longer will it be taught just to those who choose the subject because they are interested in it, or to those who see its relevance to their future occupations. Design and Technology will become something quite different from that Design and Technology to offered in the past, as its content must now be relevant to all. It must have broadly based transferable skills making it a preparation for life, not for a vocation.

To meet the legal requirements of the Orders, Design and Technology will not be able to be the province of a single department, let alone the province

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[4] IT capability in the NC is cross curricula. Pupils will use IT to; communicate and handle information; design, develop, explore and evaluate models of real or imaginary situations; measure and control physical variables and movement; and be able to make informed judgements with regard to applications and their effect on society.

of a single subject. A number of *Working Party Reports* were published for consultation before the Statutory Orders were finally written (National Curriculum Design and Technology Working Group, 1988; Department of Education and Science, 1989; National Curriculum Council, 1989). One of these reports, the *Interim Report*, set out to explain the new philosophy. It established that in order to deliver the NC the curriculum areas of CDT, Home Economics, Art and Design, Business Studies and Information Technology all have to work together as a team being aware of and building upon knowledge gained in other curriculum areas such as Sciences, Mathematics, and Humanities. Cross-curricula activities and links will be essential to achieve many of the Design and Technology programs of study. This is going to require teachers who are willing to work as part of teams and teachers who are able to work in partnership alongside teachers who possess differing skills and expertise.

Information Technology (IT) has a special role to play in Design and Technology, but it is not its only role. The *Statutory Orders for Technology* explain that like Design and Technology, Information Technology is not a discrete subject. The aim is to use IT as a tool in whatever context it is needed. All graduates should be unafraid of computers and be able to cope with whatever computer technology comes their way in the future.

Industrial Contexts and Links in Design and Technology / National Curriculum . It is envisaged that industrial links established through TVEI will be strengthened and that the good practice established under this scheme will filter into all Design and Technology activity even in the primary sector (age 5 - 11). The NC's inclusion of Business Studies into Design and Technology activities allows the design process to be more holistic.

Pupil's Learning Strategies in Design and Technology / National Curriculum . The NC suggests learning strategies that require pupils to carry out a needs-driven design activity. There is an emphasis on process and on *how* pupils will learn as well as *what* they will learn. Design and Technology is to be an activity subject, designing, making and evaluating, systems, environments and products. Projects are to be set in a number of different contexts that are relevant to all pupils. Pupils will need to work in a variety of ways; as individuals, as part of teams on one project, and as part of groups on individual tasks. The skills that will be required for a pupil to achieve a task will be on a “need to use basis.” This is where the teacher with single subject expertise will be an essential “commodity.” Pupils will learn that Design and Technology is all about optimization and opportunities and that not everything is a problem to be solved.

Teaching Strategies in Design and Technology/National Curriculum. As with all the NC subjects, progression is an important issue. It is hoped that pupils will not repeat aspects of work in a variety of curriculum areas nor if they change schools. It is also hoped that the NC will prevent pupils missing

vital areas of knowledge or experience either because they have not been included in a subject area or because a school chooses not to tackle them. It is envisaged that knowledge gained in other curriculum areas, particularly in Science and Maths, will be put into context in Design and Technology.

The Implications of the National Curriculum for Staff Development. The implications for training for teachers is tremendous. Many teachers, both those who understand the new philosophy and those who do not, are going to need a great deal of support. All teachers will need to be facilitators rather than founts of knowledge. Managers for both the curriculum and for teams of staff will be required. Monitoring individual pupils' progress will require a new approach. Assessment of work carried out by pupils at all the Key Stages could cause many challenges and difficulties.

In-service requirements are going to come in two forms: those aspects which the school can deal with in-house, such as team management, learning to work together in teams, trusting one another and accepting that no one person can deliver Design and Technology, and in-service supplied by outside agencies (Technology Education Development Unit, 1990; LIST, 1990). It will be necessary to develop an understanding of the new Design and Technology philosophy in a wider than single school context. In-service will be needed to help overcome many teachers' fears that they will not be able to cope with implementing the new Design and Technology curriculum. There will also be an on going need for in-service from outside agencies to update teachers' expertise in areas of technology as yet unknown or missing from the individual school teams of Design and Technology teachers.

Conclusion

Educational developments within curriculum areas cannot be seen in isolation. The large scale intervention of Government and Industry into the UK educational system has brought about fast changes across the total curriculum, culminating in the sharp focus of the National Curriculum.

Many valued, experienced teachers in the UK, not only of Design and Technology but across the total school curriculum, are feeling the pressures of these changes. These feelings are understandable. Teachers have recently become surrounded by a plethora of educational developments far beyond their curriculum area, which they must discuss, initiate, respond to, administer, and assess.

The UK is at the beginning of a new era in education in which the National Curriculum will hopefully give all pupils equal entitlement to a better, all around education. For Design and Technology, it is a time of major opportunity. Teachers will need to seize this opportunity to develop and deliver this vital area of the curriculum in a coherent form that will be accepted by the whole of the educational fraternity. They will need to capitalize on the good practice which already exists in schools. The National Curriculum will not

be something that can be implemented overnight. It was begun in the primary schools in September 1989 in Science, English and Mathematics. In September 1990, Technology (with its two profile components, Design and Technology and Information Technology) will begin to be taught. But it will not be until the mid-1990s that the full National Curriculum is expected to be implemented.

Many teachers are afraid of the impending changes. A great deal of in-service work will be needed to help staff cope with the philosophy, management, assessment, and extra work load. Teachers will need to be careful that they ensure that those specialists who feel vulnerable working within this new system understand the important contribution they are able to make. It is likely that these vulnerable teachers will be those who were trained as Craft teachers and have already struggled with differing degrees of success to become CDT teachers during the 1970s and 1980s. The profession will lose some of these teachers if they are made to feel that their skills are no longer relevant. It will be important for teachers to see that although pupils will be working across the full spectrum of Design and Technology, activity teachers with special expertise will be needed to prevent the subject becoming shallow and rigorless. All teachers will need a generic grasp of technology. They will also need an understanding of the variety of methods of delivering Design and Technology that are envisaged in the NC proposals.

Teachers in the UK see the need for, and the advantages of the National Curriculum framework. Design and Technology teachers understand the need for the changes that are envisaged, accepting the challenges offered to them, and recognizing the important role of Design and Technology within a holistic context. The challenges and opportunities to teachers and pupils alike are exciting. Design and Technology can and will play a special role in preparing pupils for life, enabling them to cope with the technological uncertainties of the 21st century. It will be during the next few years that teachers will need to develop and refine further mechanisms to deliver and assess this vital area of the school curriculum.

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